

## CLAIMS

We claim:

- 1 1. A mode controlled transmission line, comprising:
  - 2 a waveguide;
  - 3 a structure defining at least one cavity disposed within said waveguide;
  - 4 a conductive fluid, wherein said waveguide has at least a first operational state in which said at least one cavity is filled with said conductive fluid and at least a second operational state in which said at least one cavity is purged of said conductive fluid;
  - 5 at least one composition processor adapted for changing at least one among an electrical characteristic and a physical characteristic of the mode controlled transmission line by manipulating a volume of said conductive fluid; and
  - 6 a controller for controlling said composition processor in response to a transmission line mode control signal.
- 12
- 1 2. The mode controlled transmission line according to claim 1 wherein said transmission line has a first cutoff frequency in said first operational state and a second cutoff frequency different from said first cutoff frequency in said second operational state.
- 4
- 1 3. The mode controlled transmission line according to claim 1 wherein said waveguide has a first electrical length in said first operational state and a second electrical length different from said first electrical length in said second operational state.
- 4
- 1 4. The mode controlled transmission line according to claim 1 wherein said structure is comprised of a plurality of fluid conduits, each defining an elongated cavity, and arranged in a row to form an effective waveguide wall.
- 3

1    5.    The mode controlled transmission line according to claim 4 wherein said  
2    plurality of fluid conduits extend from a first wall of said waveguide to an second  
3    wall of said waveguide, said second wall being spaced from said first wall.

1    6.    The mode controlled transmission line according to claim 5 wherein said  
2    conductive fluid contained in said plurality of fluid conduits in said first state forms  
3    an electrical connection with said first and second walls.

1    7.    The mode controlled transmission line according to claim 1 wherein said  
2    structure is a dielectric structure comprised of at least a first solid dielectric wall  
3    extending from a first conductive wall of said waveguide to a second conductive  
4    wall of said waveguide, said second conductive wall being spaced from said first  
5    conductive wall.

1    8.    The mode controlled transmission line according to claim 7 wherein said  
2    cavity is defined between said first dielectric wall and at least one conductive wall  
3    of said transmission line.

1    9.    The mode controlled transmission line according to claim 7 wherein said  
2    dielectric structure is further comprised of a second dielectric wall, and said cavity  
3    is defined between said first and second dielectric walls.

1    10.   The mode controlled transmission line according to claim 1 further  
2    comprising a fluid control system for transferring said conductive fluid into and out  
3    of said at least one cavity responsive to a control signal.

1 11. The mode controlled transmission line according to claim 1 wherein said  
2 conductive fluid is comprised of an industrial solvent having a suspension of  
3 magnetic particles contained therein.

1 12. The mode controlled transmission line according to claim 11 wherein said  
2 magnetic particles are formed of a material selected from the group consisting of  
3 ferrite, metallic salts, and organo-metallic particles.

1 13. A method of controlling the mode of a transmission line comprising the steps  
2 of:

3 providing at least one waveguide filter cavity within a waveguide;  
4 at least partially filling said waveguide filter cavity with a conductive fluid;  
5 propagating said RF signal within said waveguide; and  
6 changing at least a volume of said conductive fluid to selectively vary at  
7 least one of a physical dimension of the waveguide or an electrical dimension of the  
8 RF signal in response to a waveguide mode control signal.

1 14. The method according to claim 13 further comprising the step of  
2 constraining said conductive fluid in a portion of said waveguide to modify a cutoff  
3 frequency of said waveguide.

1 15. The method according to claim 13 further comprising the step of  
2 constraining said conductive fluid in a portion of said waveguide to modify an  
3 electrical length of said waveguide.

1 16. The method according to claim 13 further comprising the step of  
2 constraining said conductive fluid in a plurality of fluid conduits, each defining an  
3 elongated cavity, and arranged in a row to form an effective waveguide wall.

1 17. The method according to claim 16 further comprising the step of forming an  
2 electrical connection between said conductive fluid and at least one conductive  
3 wall of said waveguide.

1 18. The method according to claim 13 further comprising the step of  
2 constraining said conductive fluid using at least a first solid dielectric wall  
3 extending from a first conductive wall of said waveguide to a second conductive  
4 wall of said waveguide, said second conductive wall being spaced from said first  
5 conductive wall.

1 19. The method according to claim 18 further comprising the step of  
2 constraining said conductive fluid between said first dielectric wall and at least one  
3 conductive wall of said waveguide.

1 20. The method according to claim 19 further comprising the step of  
2 constraining said conductive fluid between said first dielectric wall and a second  
3 dielectric wall.